

STEREO MOC Status Report
Time Period: 2015:187 - 2015:193

STEREO Ahead (STA) Status:

1. The following Ground System anomalies/events occurred during this reporting period:

- On day 187, during the DSS-14 support, with the observatory rotating at 5 degrees per minute on the -Z LGA, telemetry lock was never received due to the low signal strength as the LGA is on the edge of the hemispherical pattern. Carrier lock was solid throughout the support with the carrier power between -168 and -177 dBm.
- On day 188, during the DSS-63 support, with the observatory rotating at 5 degrees per minute on the +Z LGA, telemetry lock was never received due to the low signal strength as the LGA is on the edge of the hemispherical pattern. Carrier lock was mostly continuous, with occasional drop outs at lower elevation, with the carrier power between -169 and -176 dBm.
- On day 189, during the DSS-14 support, after the 35th HCLT initiated system reset with the observatory under 3-axis attitude control again using the 2nd HGA side lobe, telemetry was received nine minutes early at 1341z. RF communications were reasonable with occasional dropouts due to solar interference with a command success rate of 65% and over 76% of the expected telemetry frames received. Due to the effects of solar scintillation, most commands were sent three or more times to ensure reception.
- On day 190, during the DSS-14 support, RF communications were reasonable with occasional dropouts due to solar interference with a command success rate of 85% and over 84% of the expected telemetry frames received. Due to the effects of solar scintillation, most commands were sent three or more times to ensure reception.
- On day 191, during the DSS-14 support, RF communications were very good with occasional dropouts due to solar interference with a command success rate of 97% and over 98% of the expected telemetry frames received. Due to the

effects of solar scintillation, most commands were sent three or more times to ensure reception.

- On day 192, during the DSS-14 support, RF communications were very good with occasional dropouts due to solar interference with a command success rate of 98% and over 99% of the expected telemetry frames received. Due to the effects of solar scintillation, most commands were sent three or more times to ensure reception.
- On day 193, during the DSS-14 support, RF communications were again surprisingly good with only occasional dropouts due to solar interference with a command success rate of 99% and over 99% of the expected telemetry frames received.

2. The following spacecraft/instrument events occurred during this week.

- On day 189, July 8th, after the 35th and last HCLT initiated system reset at a 2.0 degree SPE angle, superior solar conjunction exiting recovery operations began. The observatory continued to operate nominally, 3-axis stabilized while communicating on the 2nd HGA side lobe. Commanding to reconfigure the spacecraft bus from solar conjunction exiting began and the following significant activities were completed:
 - Disabled wheel #3 from G&C control
 - Increased downlink rate to 3 kbps to flow instrument real-time telemetry (SWAVES as it remains on)
 - Applied leap second
 - Spacecraft bus SSR data playback
 - Loaded and verified track timetags through July 9th

The IMPACT and PLASTIC space weather SSR partitions were unchanged, 53.2 and 51.0 percent full respectively, and SWAVES, which has remained on through solar conjunction recording at one packet per minute, is at 51.6 percent full. The HGA feed temperature remains within the predicted range at 114 degrees C. System momentum was at 7.4 Nms and decreasing. As occurred during solar conjunction entry, after the 35th HCLT reset, the star tracker was again "lazy" in re-acquiring a solution causing IMU2 to power on for two hours. G&C reaction wheel #3 continued not responding to G&C torque commands. Further

contingency response to this G&C anomaly will be conducted after G&C SSR data is downlinked and analyzed.

- On day 190, July 9th, during the track with DSS-14, solar conjunction exiting recovery operations continued with the observatory continuing to operate nominally, 3-axis stabilized while communicating on the 2nd HGA side lobe. The HGA feed temperature remains within the predicted range at 113 degrees C. System momentum is at 7.3 Nms and decreasing. The following significant activities were completed:
 - Powered on IMPACT IDPU/MAG at 1550z
 - Powered on IMPACT SEP/SEPT at 1800z
 - Powered on PLASTIC at 1840z
 - Continued S/C bus SSR playback of solar conjunction housekeeping
 - Loaded and verified track timetags through July 19th

IMPACT Status - The instruments that we've powered on look good (MAG, SIT, HET, LET and SEPT). SWEA and STE are off until we exit the side lobes later in the year. MAG is producing science data which is already being plotted at the SSC. The SEP suite, except for SIT, should be in science mode tomorrow. SIT will up in a few days.

- On day 191, July 10th, during the track with DSS-14, solar conjunction exiting recovery operations continued with the observatory continuing to operate nominally, 3-axis stabilized while communicating on the 2nd HGA side lobe. The HGA feed temperature remains within the predicted range at 113 degrees C. System momentum is at 7.3 Nms and decreasing.

IMPACT Status - MAG and SEPT have been configured for producing science. (SWEA and STE will remain powered off until we return to the main lobe.) Due to communication interference, efforts to patch LET have been slowed and will continue on day 194. HET is producing some science, but a table load needs to be completed on day 194 to get back to its nominal state. SIT has a bit more configuration to do as well plus its high voltage needs to ramp up so it will be sometime next week before it is producing science. All these instruments appear to be healthy. We've seen no anomalous behavior after the long conjunction period so we're quite happy.

PLASTIC Status - began increasing the high voltage and the PAC reached 5 kV

S/C C&DH and G&C Housekeeping SSR Data:

- C&DH housekeeping = Days 133 and 134
 - G&C housekeeping = Days 133 through 137
- On day 192, July 11th, during the track with DSS-14, solar conjunction exiting recovery operations continued with the observatory continuing to operate nominally, 3-axis stabilized while communicating on the 2nd HGA side lobe. The HGA feed temperature remains within the predicted range at 113 degrees C. System momentum is at 7.3 Nms and decreasing.

PLASTIC Status - Continued increasing high voltages

SECCHI Status - Powered on at 1647z and began recovery. Schedules were loaded and the instrument was in operational mode at 1955z. The spacecraft enabled GT usage and fine pointing was achieved. The spacecraft state was transitioned to operational mode at 2028z.

S/C C&DH and G&C Housekeeping SSR Data Return:

- C&DH housekeeping = Days 134 and 135-0118z
 - G&C housekeeping = Days 137 through 145-0736z
- On day 193, July 12th, during the track with DSS-14, solar conjunction exiting recovery operations continued with the observatory continuing to operate nominally, 3-axis stabilized while communicating on the 2nd HGA side lobe. The HGA feed temperature remains within the predicted range at 113 degrees C. System momentum is at 7.5 Nms and increasing.

PLASTIC Status - Continued increasing high voltages

SECCHI Status - After analysis of telemetry today, a table loading error caused the GT data to be invalid near the end of yesterday's track which led to a false indication and reporting of a SECCHI instrument reset. SECCHI remained in operational mode generating images during the night and the table error was corrected today.

SSR partitions percent full status:

IMPACT space weather = 54.0
PLASTIC space weather = 51.0
SWAVES space weather = 52.4

S/C C&DH and G&C Housekeeping SSR Data Return:

As analysis of the event and anomaly SSR data indicates that the SLVS anomalies began on day 134, the S/C housekeeping SSR read pointers were repositioned to day 133 to begin playing back anomaly data of interest. There are approximately 12 days of interest, and all if goes well, all of this data should be received by next day 196, July 15th. Data downlink today includes:

- C&DH housekeeping = Days 135 through 135-0335z
- G&C housekeeping = Days 145 through 151-1958z

Known Issues:

1. G&C reaction wheel #3, currently disabled, not responding to torque commands. Data is being analyzed as it is received.
2. Preliminary analysis of the SSR anomaly data partitions indicates that 4 soft low voltage shutdowns (SLVS) occurred during solar conjunction. While fault protection recovered the observatory each time, housekeeping data is being analyzed as it is downlinked. As the SLVS response will power down all instruments, SWAVES data will have a gap starting on day 134 for at least 12 days.

STEREO Behind (STB) Status:

1. The following Ground System anomalies/events occurred during this reporting period:
 - None.
2. Detailed status of the activities that occurred on the Behind loss of communication anomaly, which occurred on day 2014-274, are listed below.
 - The Behind observatory entered superior solar conjunction at the 2.0 degree SPE angle on day 022. Recovery efforts

resumed post solar conjunction on day 124, May 4th through day 178, June 27th, as the spacecraft had cleared solar interference for LGA communications. The Failure Review Board recommendations were implemented consisting of battery state of charge recovery and powering on the downlink carrier. The Green Bank Radio Telescope and the Arecibo Observatory also observed the carrier recovery tracks. To date, no downlink signal has been detected from the Behind observatory. Due to Behind's retrograde motion causing it to re-enter the region of solar interference, recovery operations will be suspended from July through November. The Failure Review Board's recommended faster frequency segmented acquisition sequence will be tested with the Ahead observatory in September. The DSN uplink arraying capability will be tested again with the Ahead observatory in October and November, and when it is ready, it will be used to increase the spacecraft received signal power to assist with Behind recovery commanding. With time the spacecraft range improves RF communications and the ability for other assets to acquire data on Behind. LGA uplink margin returns to 6 dB for the 7.8 bps rate in March 2016 and 125 bps in December 2019 and the LGA downlink margin returns to 3 dB for the 12 bps rate in December 2016 and 35 bps in March 2018.

Significant findings to date:

1. Analysis of the three DSN extracted telemetry frames from the carrier signal just before the planned observatory reset/anomaly occurred on day 2014-274, October 1st, showed nominal performance of the spacecraft, i.e., no anomalies, IMU off, and the star tracker providing an attitude solution.
2. Post reset, from the very limited telemetry, three packets, extracted from the carrier signal by the DSN, the X-axis gyro on IMU-A had failed. Unfortunately, this telemetry contained only G&C anomaly data and no spacecraft summary data, i.e., the state of the RF, G&C, fault protection and other subsystems is not known at the time of the anomaly. With a failed IMU and the star tracker being off-line for an undetermined duration, the sun sensors will keep the observatory pointed at the Sun, though the G&C will not have any roll knowledge, and cannot roll the observatory as part of the safing configuration to re-establish communications on the LGAs. From analysis of

this telemetry and initial G&C simulations, it is highly suspected that the observatory is rotating about the principal axis of inertia due to an autonomous momentum dump initiated by biased gyro data flagged good by the IMU, but this has not yet been confirmed.

3. At least two anomalies occurred post reset, the star tracker not promoting to AAD mode and the X-axis gyro failure. Unfortunately, due to the number of possible combinations, the STEREO fault protection system is not designed for simultaneous failures.

The cause and effect analysis of the loss of communications from the LGAs is continuing. G&C simulations using the biased gyro data flagged good by the IMU are continuing to better understand the potential impact to the observatory state. Recovery from a negative power state is also being investigated. While the recovery and analysis efforts continue on Behind, as the Ahead observatory will enter superior solar conjunction in March, the primary focus of the engineering team is on developing operational configuration changes to add robustness to the G&C rate sensor usage to ensure the Ahead observatory's continued safety.

Once communications are restored and the anomaly resolved, the Behind observatory will be returned to nominal science data collection as soon as it is safely possible.